DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
DEFENSE SCIENCES OFFICE (DSO)
PLANNED PROCUREMENTS
May 1998

PROGRAM DESCRIPTION	FUNDING	SCHEDULE	PROGRAM MGR
Mesoscale Machines for Military Applications: The objective of this program is to demonstrate working mesoscopic machines that meet performance specifications of interest to the Department of Defense (DoD). Mesoscopic machines are those machines that straddle the size range between MEMS and conventional machines. Choices for the machine should be justified based on performance advantages at the mesoscopic scale as well as utility to the DoD. Innovative devices and design flexibility are encouraged, especially mesoscopic machines that provide considerable improvements over existing solutions or provide entirely new ones to military problems. Specific areas of interest are mesoscale machines for purification of water, purification of air, small amphibious machines, electrostatic machines, and meso-weapons.	N/A	BAA98-23 Proposals due 5/29/98 Total program: 3 years	Dr. William Warren DSO
Optimized Portable Algorithms and Application Libraries (OPAAL) Initiative for Complex Physical Simulation: This program is aimed at the development and application of methodologies for automated generation of high-performance, scaleable codes for critical computational kernels. Approaches of interest should allow explicit mathematical expression and manipulation of application- and architecture-dependent features of algorithms that impact runtime performance for broad classes of architectures and applications. Of particular interest are critical computational kernels having pervasive impact and general applicability in a broad variety of materials processing and other DoD-relevant simulation technologies, such as mesh generation and front capturing.	$4M combined DARPA and NSF funding	NSF BAA98-64 Proposals due 7/1/98 Total program: 3 years	Dr. Anna Tsao DSO

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Innovative Computational Mathematics for Physical Applications: This program seeks to develop and demonstrate substantive advances in the following three technical areas: (1) physics based modeling and signal processing applied to optimization of DoD sensor systems; (2) modeling, data analysis, or scalable high order numerical methods for applications in electromagnetics, sensing, and chemical or biological systems; and (3) development and application of mathematical formulations enabling automatic compilation of scaleable, high-performance software libraries of key numerical kernels for DoD sensor applications. Projects must demonstrate significant mathematical innovation and the potential for high DoD payoff.	N/A	AFOSR BAA 98-44 Proposals due 9/30/98 Total program: 3 years	Dr. Anna Tsao, Dr. Dennis Healy DSO
Single Crystal Piezoelectrics for Electromechanical Transduction: This program exploits recent research results demonstrating that single crystals of relaxor piezoelectrics exhibit electromechanical coupling exceeding 90% (compared to about 75% in conventional piezoceramics) and strain levels exceeding 1% (compared to about 0.1% in conventional piezoceramics), providing an order of magnitude enhancement in solid-state electromechanical actuator performance. The initial phase of 2 to 3 year projects will concentrate on devising innovative growth methods, understanding microscopic origins optimizing composition, properties, and processing, and identifying and demonstrating -- on a laboratory scale -- materials performance in applications addressable with initially produced samples. A second phase of 2 to 3 year projects will scale up materials production methods and demonstrate performance in selected high-impact defense applications ranging from helicopter rotor control, through wing shape control, to naval sonar systems.	$25M	BAA92-22 Proposals due 10/9/98 Total program: 4-5 years	Dr. Wallace Smith DSO

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Unconventional Pathogen Countermeasures: The purpose of this program is to develop and demonstrate defensive technologies which afford the greatest protection to primarily uniformed warfighters and the defense personnel who support them during US military operations. Ideally, these defenses will be instantly available or emplaced countermeasures that can defeat biological threats as they enter the body and before they reach and attack target cells and tissues. The focus of this program is to develop revolutionary, broad-spectrum, medical countermeasures against significantly pathogenic micro-organisms and/or their pathogenic products. These countermeasures should be versatile enough to eliminate biological threats, whether from natural sources or modified through bio-engineering or other manipulation.	$30M	BAA 3QFY98 Total program: 3 years	CDR Shaun Jones DSO
Advanced Diagnostics: The objective of this program is to provide the capability to detect, in clinical samples or in the body, in real-time and in the absence of recognizable signs and symptoms (when pathogen numbers are still low), the presence of infection by any significant pathogen. Specific areas of interest include but are not limited to: (1) multi-agent diagnostics capable of simultaneously identifying a broad range of pathogens (infectious agents and/or their products); (2) strategies for identifying both known and presently unknown or bio-engineered pathogens (e.g., diagnostic approaches based upon fundamental, critical mechanisms of pathogenesis, targets shared by classes of pathogens, or early host responses to infection); (3) detection and identification of biosignatures or biomarkers that could serve usefully to indicate exposure or infection and provide useful diagnostic or prognostic information, especially early in infection; (4) capabilities for continuous monitoring or immediate recognition of infection in the body; and (5) wearable diagnostics for noninvasive, broad-spectrum detection of infection in the body.	$10M	BAA 3QFY98 Total program: 3 years	Dr. Stephen S. Morse DSO

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Moletronics: The objective of this program is to demonstrate the integration of molecular components into scalable, functional devices that are interconnected to the outside world. The long-term goal is to provide moderate computational power in an extremely small, low-power format – a "Pentium on a pin-head." The immediate program has two specific goals: (1) demonstrate a functional 16-bit molecular memory connected to the outside world at a density of 10^{12} bits/mm^3 that is capable of performing a storage function that is bistable, and reversibly driven from one state to the other by an outside signal at room temperature; and (2) demonstrate two interconnected molecular logic gates (10nm x 4nm in size) connected to the outside world that produce the correct truth table.	$15M	BAA 3Q or 4QFY98 Total program: 2 years	Dr. Bruce Gnade ETO Dr. William Warren DSO
Mesoscopic Integrated Conformal Electronics (MICE): The purpose of this program is to demonstrate the rapid prototyping and manufacturing of miniaturized and rugged mesoscopic electronics on any surface (silicon, glass, plastics, metals, ceramics, etc.) through the 3-dimensional integration of passive components (resistors, capacitors, inductors, high gain antennae, and interconnects) and active components (batteries, etc.) using a direct-write (mask-less) approach. The MICE direct-write machine goal is to develop a single, compact, commercial-off-the-shelf, rapid (hours) prototyping/manufacturing computer-aided-design/computer-aided-machine (CAD/CAM) that will deposit a wide variety of functional materials (conductors, insulators, ferrites, ruthenates, metals, ferroelectrics, glasses, polymers, etc.) for customized, robust, mesoscale electronic devices in a 3D fashion at low-substrate temperatures in a conformal manner on virtually any substrate. It has been determined that a "credit card"-sized Global Positioning System receiver and transmitter will be the application driving the direct-write tool development for this program. These direct-write mesoscopic electronic devices will be integrated with the physical structure (e.g., a plastic "credit card") on which the electronic systems will be used; there will be no need for a conventional printed wiring board.	$40M	BAA 3Q or 4QFY98 Total program: 4 years	Dr. William Warren DSO

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Next Generation Technologies for Environmental Bioagent Identification: This program has the goal of developing rapid, inexpensive and highly accurate environmental detection and identification technologies for biological agents. The initial phase of 2 to 3 year projects will focus on development of detection and identification technologies that do not use antibodies, DNA, or liquids in the process of identifying environmental biological agents (spores, vegetative bacteria, viruses, toxins, etc.). Emphasis will be placed on miniaturization capability of the technology, low cost, low power, and high sensitivity. A second phase will involve teaming of successful technologies, integration with air samplers into complete bio-sensor systems, and testing in realistic environments.	$15M	BAA 4QFY98 Total Program: 3-4 years	Dr. Mildred Donlon DSO
Biomimetic Systems: This program will identify and then mimic locomotory and sensory biological systems that show superior performance and stability. Projects will involve the detailed study of biological systems for control, design, and fabrication features and then construction of abiotic or hybrid prototype platforms. Candidate systems to be evaluated include (but are not limited to) active camouflage, optical/infrared/acoustic detection, resonant insect flight, and extremophile strategies used by small invertebrates. Prototypes of biomimetic systems will be developed that will demonstrate enhanced capabilities for Defense operations including sensing, surveillance, and mine countermeasures.	$15M	BAA 2QFY99 Total program: 3 years	Dr. Alan Rudolph DSO